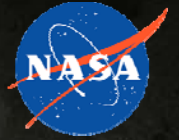


National Aeronautics and Space Administration



Danny Davis

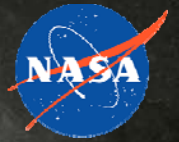
Ares I Upper Stage Manager

October 15, 2008

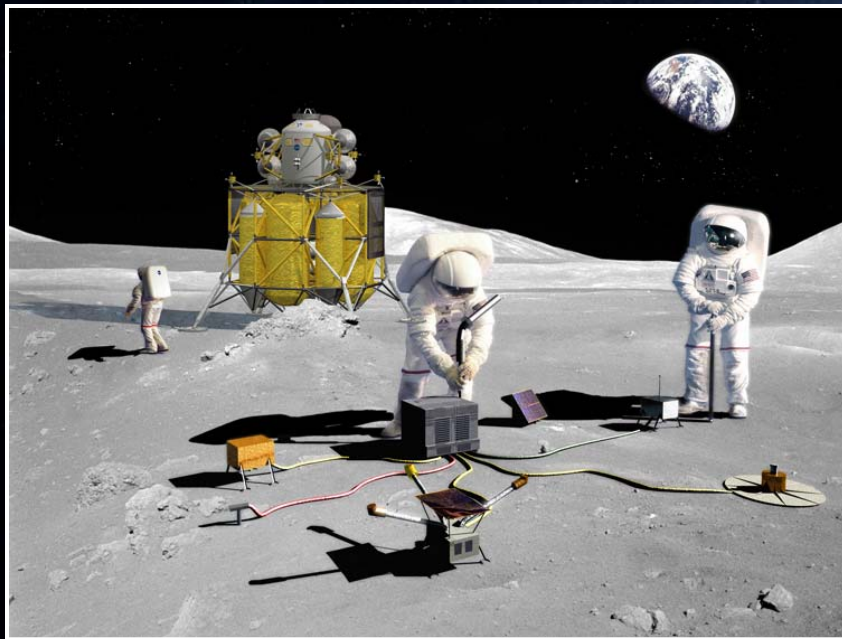


Launching to the Moon and Beyond: Ares I and V Updates

What is NASA's Mission?



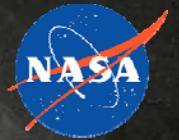
- ◆ Safely fly the Space Shuttle until 2010
- ◆ Complete the International Space Station (ISS)
- ◆ Develop a balanced program of science, exploration, and aeronautics
- ◆ Develop and fly the Orion Crew Exploration Vehicle (CEV)
 - Designed for exploration but will initially service ISS
- ◆ Land on the Moon no later than 2020
- ◆ Promote international and commercial participation in exploration



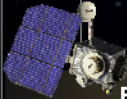
“The next steps in returning to the Moon and moving onward to Mars, the near-Earth asteroids, and beyond, are crucial in deciding the course of future space exploration. We must understand that these steps are incremental, cumulative, and incredibly powerful in their ultimate effect.”

*– NASA Administrator Michael Griffin
October 24, 2006*

NASA's Exploration Roadmap



05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25...



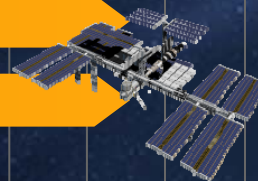
Exploration and Science Lunar Robotics Missions



Lunar Outpost Buildup

Research and Technology Development on ISS

Commercial Orbital Transportation Services for ISS



Space Shuttle Operations

SSP Transition

Ares I and Orion Development

Operations Capability Development
(EVA Systems, Ground Operations, Mission Operations)



Ares I-X
Test Flight
April 2009

Orion and Ares I Production and Operation

Altair Development



Ares V & Earth Departure Stage

Surface Systems Development

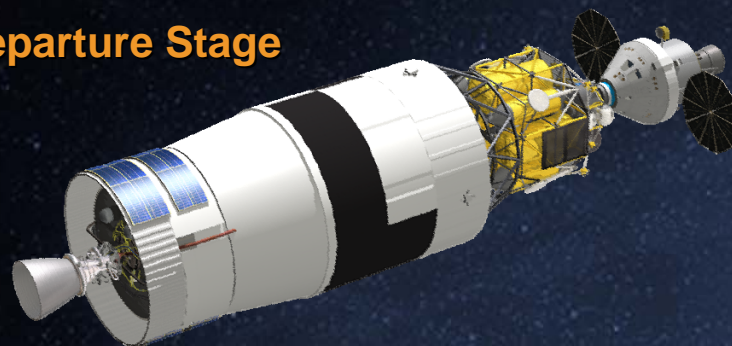




Our Exploration Fleet

What Will the Vehicles Look Like?

Earth Departure Stage



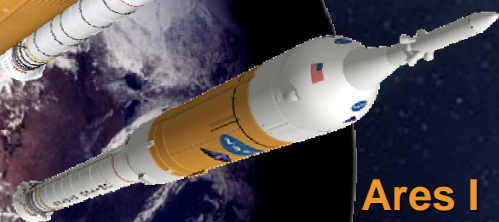
Orion
Crew Exploration
Vehicle



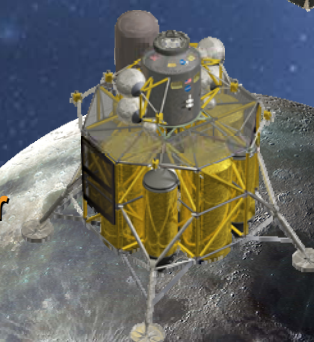
Ares V
Cargo Launch
Vehicle



Ares I
Crew Launch
Vehicle

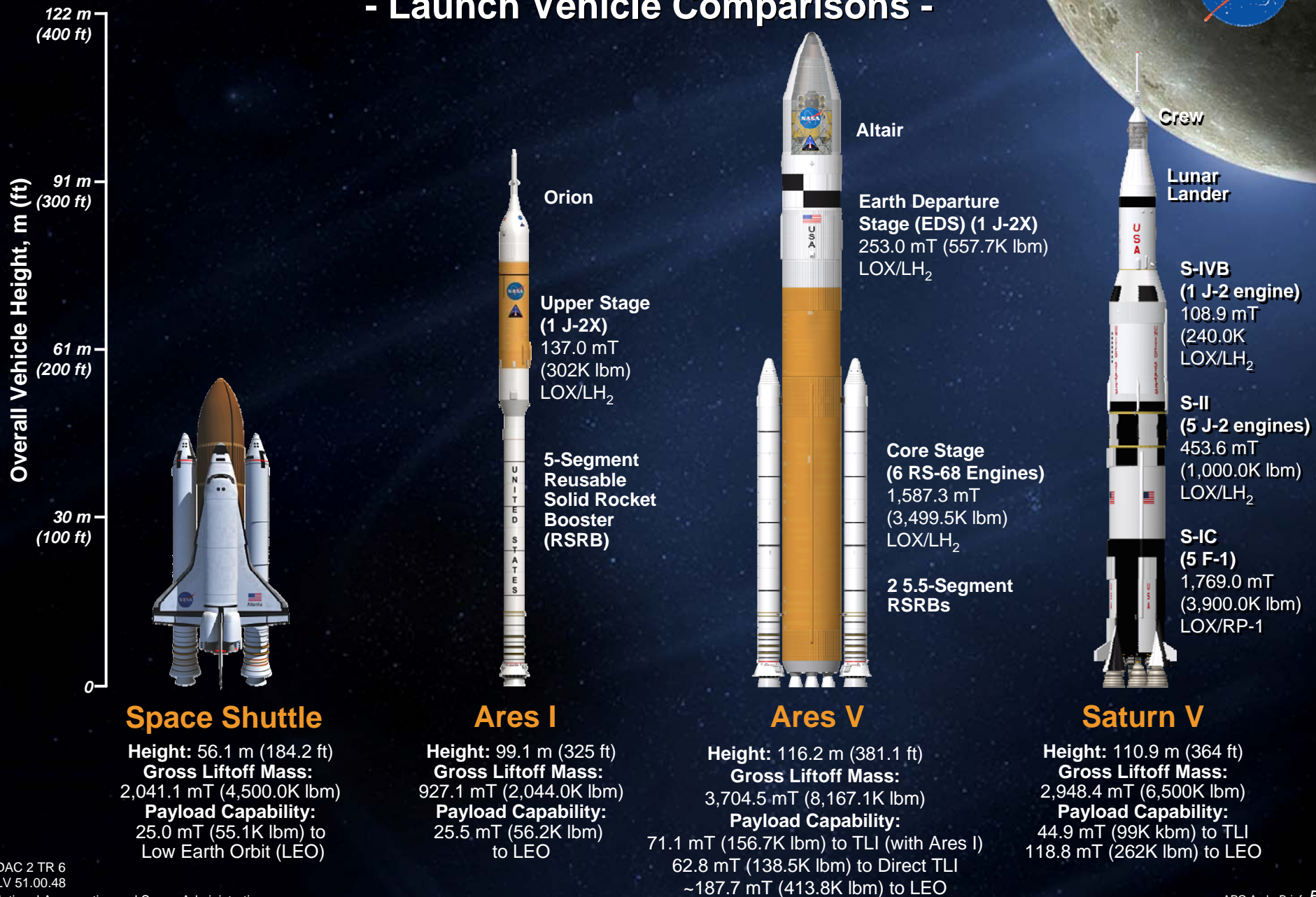


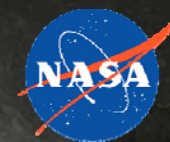
Altair
Lunar
Lander



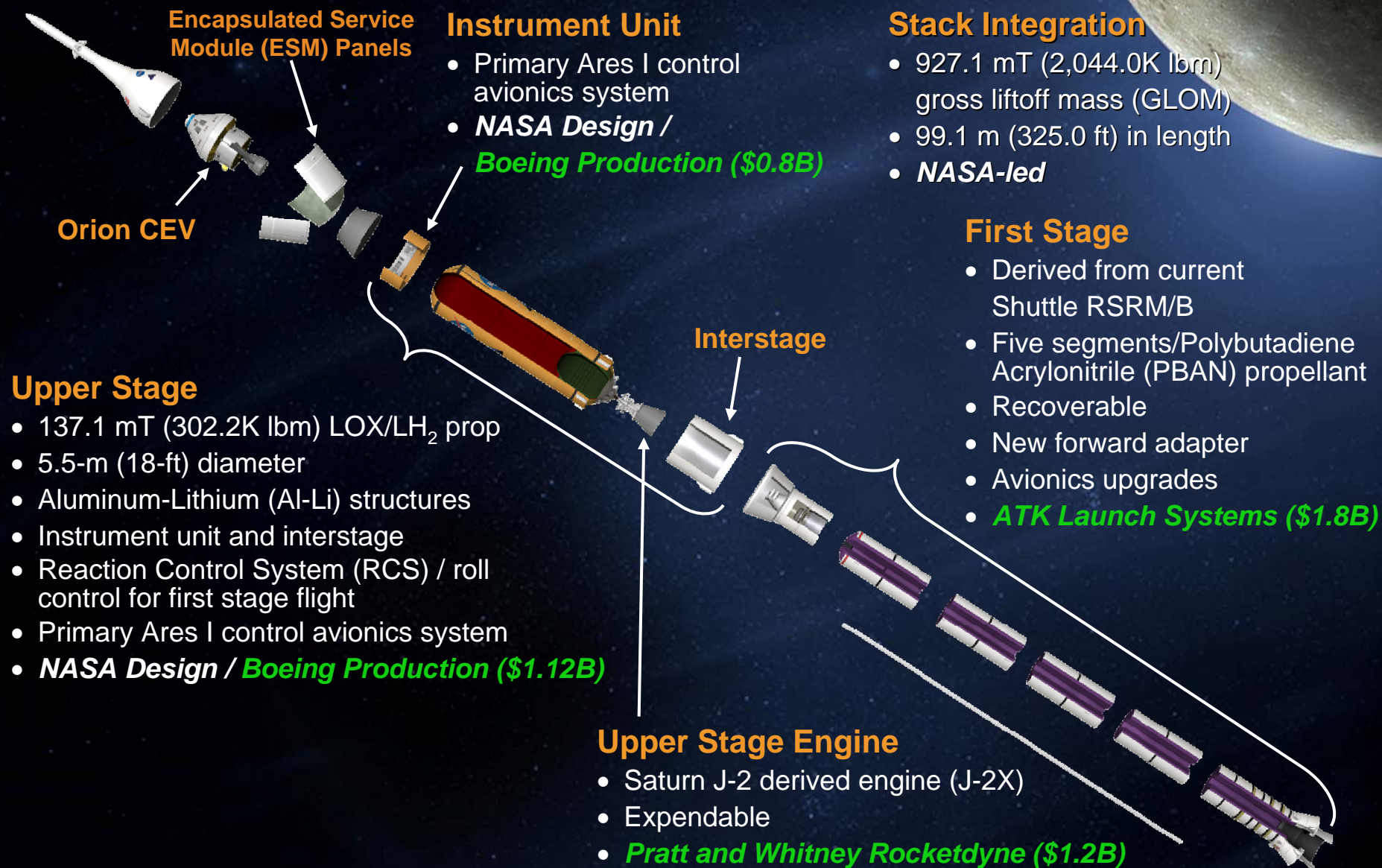
Building on a Foundation of Proven Technologies

- Launch Vehicle Comparisons -

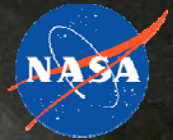




Ares I Elements



First Stage



Tumble Motors
(from Shuttle)

Composite
Frustum

Modern
Electronics

12-Fin
Forward Segment

Same propellant as Shuttle
(PBAN)—Optimized for Ares
Application

Same cases and
joints as Shuttle

Booster
Deceleration
Motors (from
Shuttle)

Wide Throat
Nozzle

Same Aft Skirt and Thrust Vector
Control as Shuttle



New 45.7 m (150 ft)
diameter parachutes



Mass: 733 mT (1,616 lbm)
Thrust: 15.8 MN
Burn Duration: 126 sec
Height: 53 m (174 ft)
Diameter: 3.7 m (12 ft)

Upper Stage



Instrument Unit
(Modern Electronics)

Al-Li Orthogrid Tank Structure

Helium
Pressurization
Bottles

LH₂ Tank

LOX Tank

Feed Systems

Ullage Settling
Motors

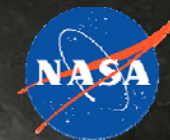
Roll
Control
System

Common
Bulkhead

Thrust Vector Control

Composite Interstage

Propellant Load: 138 mT (304K lbm)
Total Mass: 156 mT (344K lbm)
Dry Mass: 16.3 mT (36K lbm)
Dry Mass (Interstage): 4.1 mT (9K lbm)
Length: 25.6 m (84 ft)
Diameter: 5.5 m (18 ft)
LOX Tank Pressure: 50 psig
LH₂ Tank Pressure: 42 psig



Upper Stage Avionics



The Upper Stage Avionics will provide:

- Guidance, Navigation, and Control (GN&C)
- Command and data handling
- Pre-flight checkout

Instrument Unit Avionics

Aft Skirt Avionics

Interstage Avionics

Thrust Cone Avionics

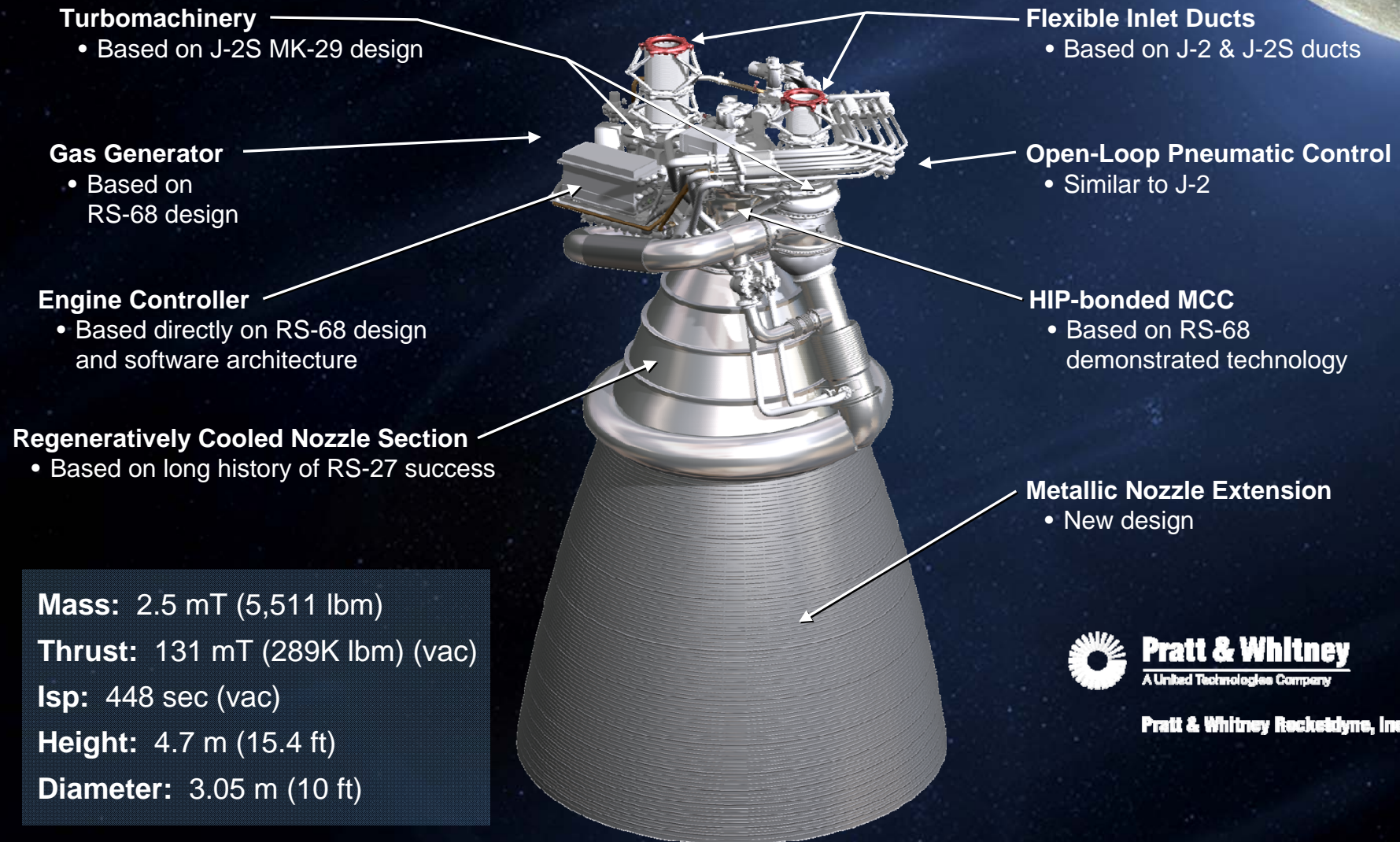
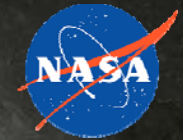


Avionics Mass: 1.1 mT (2,425 lbm)

Electrical Power: 5,145 Watts

J-2X Engine

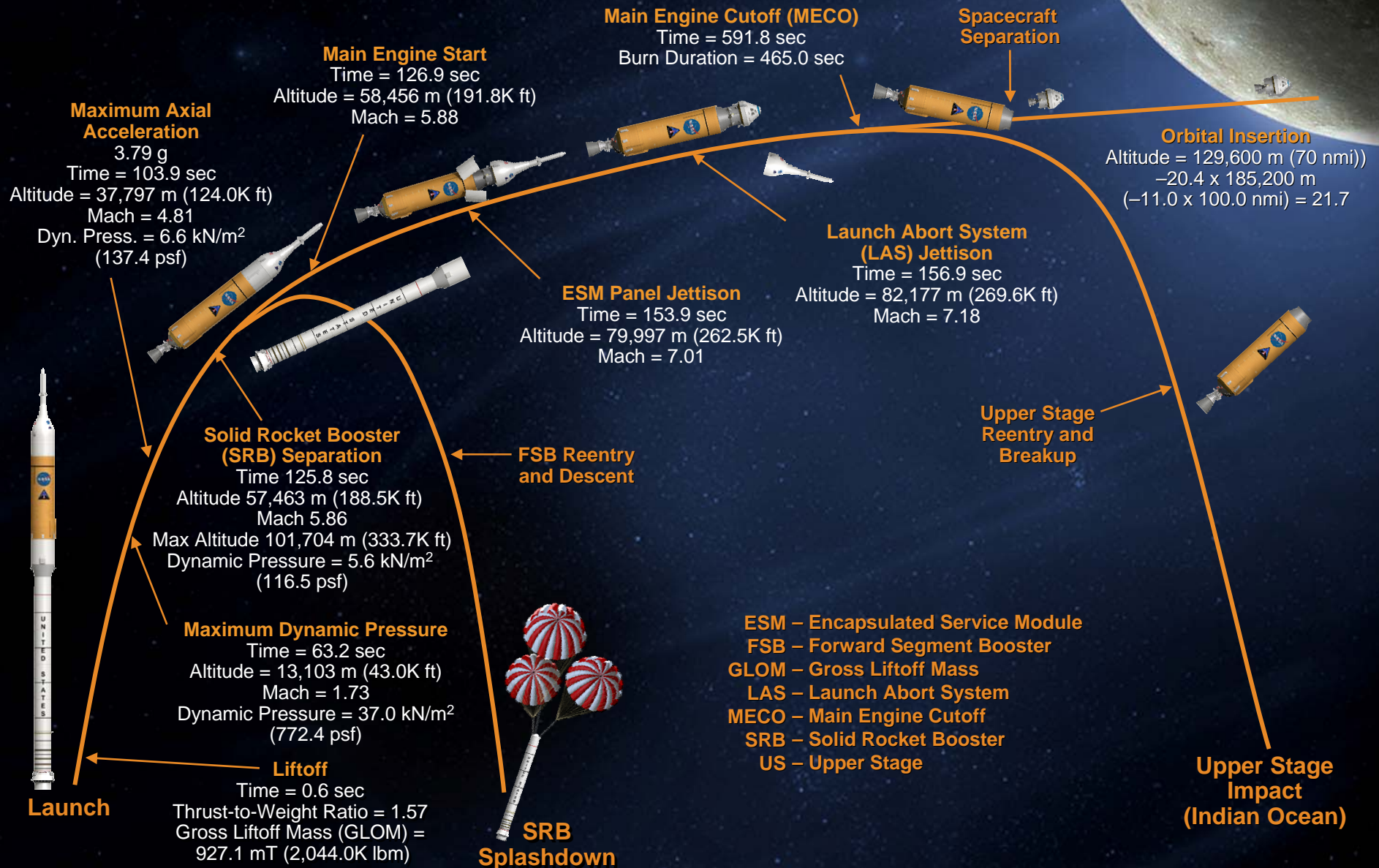
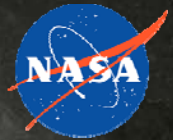
Used on Ares I and Ares V



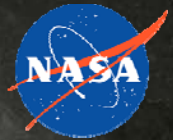
Pratt & Whitney
A United Technologies Company

Pratt & Whitney Rocketdyne, Inc.

Ares I Lunar Mission Profile



Ares I-X Test Flight



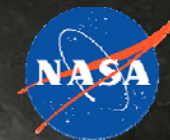
◆ Demonstrate and collect key data to inform the Ares I design:

- Vehicle integration, assembly, and KSC launch operations
- Staging/separation
- Roll and overall vehicle control
- Aerodynamics and vehicle loads
- First stage entry dynamics for recovery

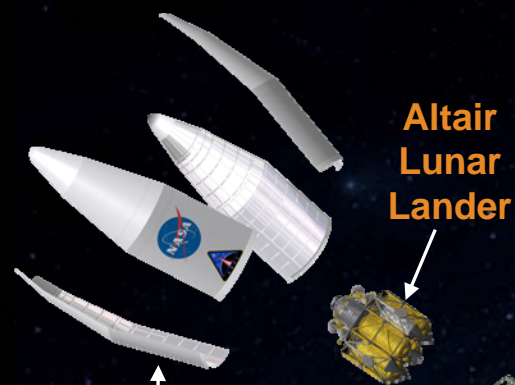


◆ Performance Data:

	Ares I-X	Ares I
First Stage Max. Thrust (vacuum):	14.1 MN	15.8 MN
Max. Speed:	Mach 4.7	Mach 5.84
Staging Altitude:	39,600 m (130K ft)	57,700 m (188K ft)
Liftoff Weight:	816 mT (1,799K lbm)	927 mT (2,044K lbm)
Length:	99.7 m (327 ft)	99.1 m (325 ft)
Max. Acceleration:	2.46 g	3.79 g



Ares V Elements



Altair
Lunar
Lander

Payload
Fairing

Stack Integration

- 3,704.5 mT (8,167.1K lbm) gross liftoff mass
- 116.2 m (381.1 ft) in length

EDS

J-2X

Loiter Skirt

Interstage

Earth Departure Stage (EDS)

- One Saturn-derived J-2X LOX/LH₂ engine (expendable)
- 10-m (33-ft) diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures, instrument unit and interstage
- Primary Ares V avionics system

Solid Rocket Boosters

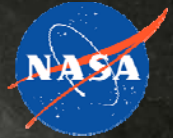
- Two recoverable 5.5-segment PBAN-fueled boosters (derived from current Ares I first stage)

Core Stage

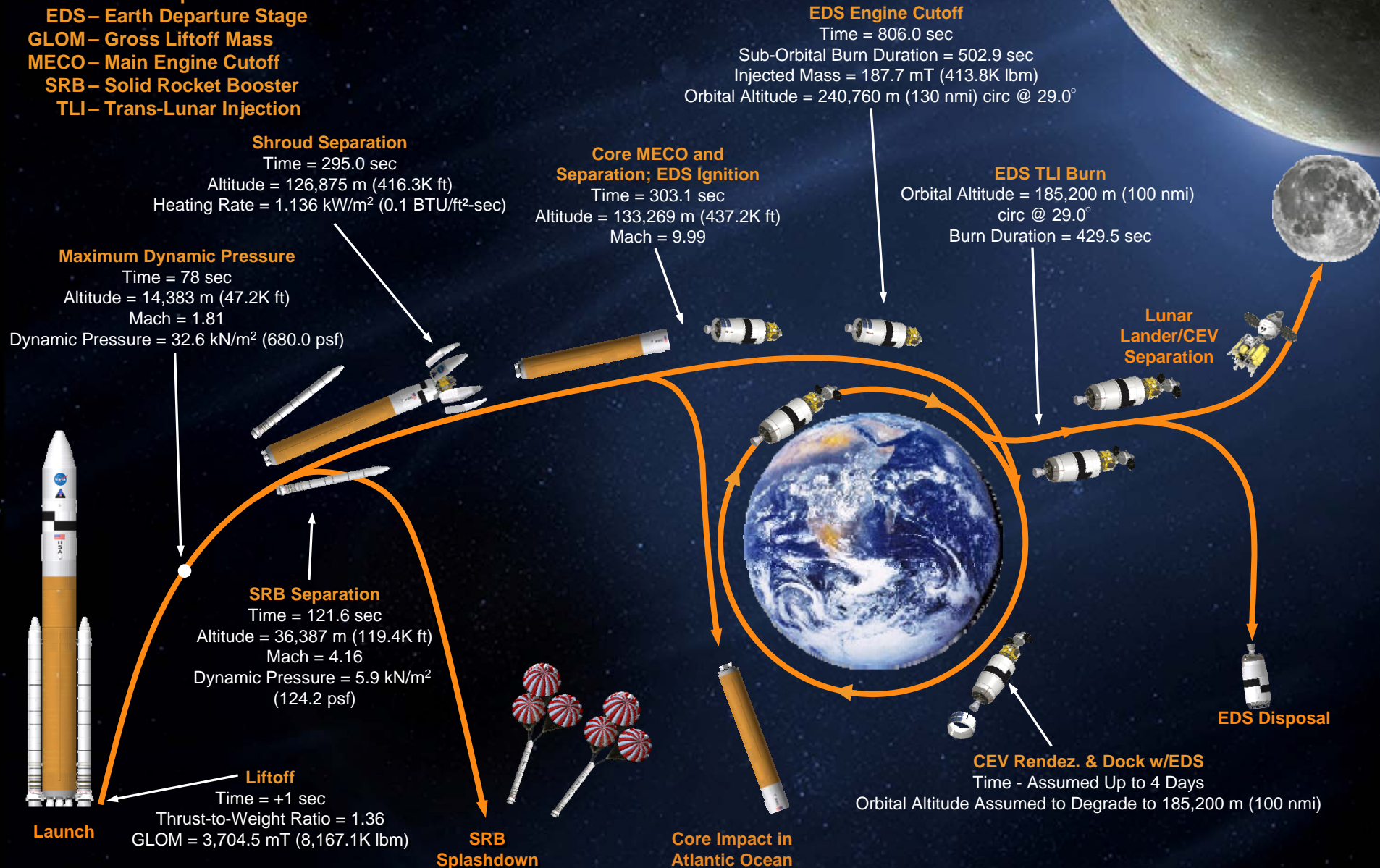
- Six Delta IV-derived RS-68 LOX/LH₂ engines (expendable)
- 10-m (33-ft) diameter stage
- Composite structures
- Aluminum-Lithium (Al-Li) tanks

RS-68

Ares V Lunar Mission Profile



CEV – Crew Exploration Vehicle
EDS – Earth Departure Stage
GLOM – Gross Liftoff Mass
MECO – Main Engine Cutoff
SRB – Solid Rocket Booster
TLI – Trans-Lunar Injection



What Progress Have We Made?



◆ Programmatic Milestones

- Completed Ares I and Element System Requirements Reviews, System Definition Reviews, and Preliminary Design Reviews
- Contracts awarded for building the first stage, J-2X engine, upper stage, instrument unit, and Orion
- RFP issued for MSFOC Contract at MAF
- Ares I-X test flight scheduled for 2009



Cutting Dome Gore Panels for LH₂ Tank



Powerpack 1A at SSC

◆ Technical Accomplishments

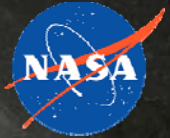
- Testing first stage parachutes and developing nozzles
- Constructing new J-2X test stand at Stennis Space Center
- Performing J-2X injector tests and power pack tests
- Fabricating Ares I-X hardware
- Robotic Weld Tool installed and operational at MSFC



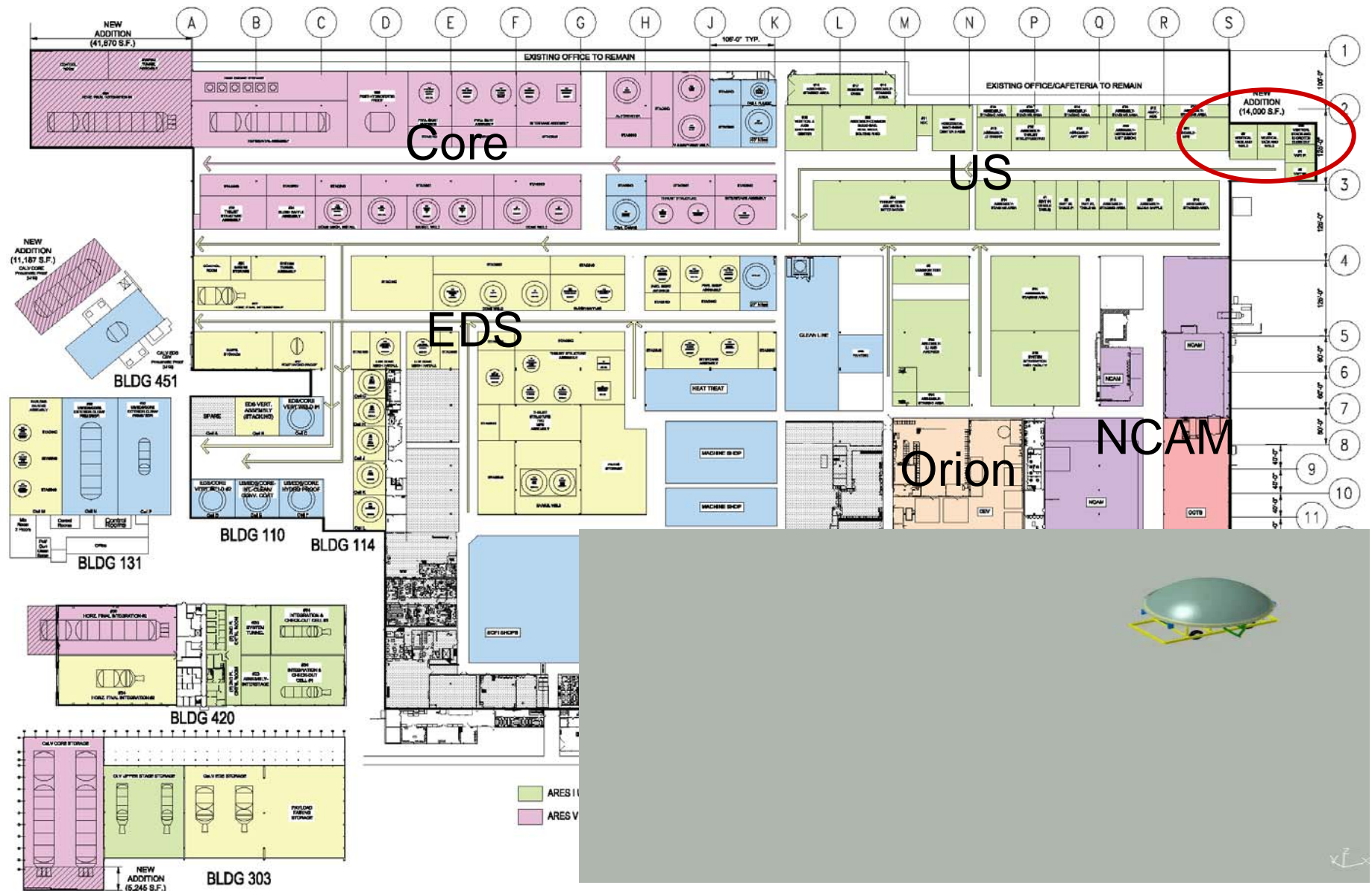
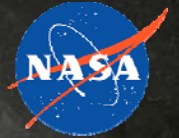
Robotic Weld Tool for Friction Stir Welding

For more information go to www.nasa.gov/ares

Ares Nationwide Team



Ares I and V Production at Michoud Assembly Facility (MAF)



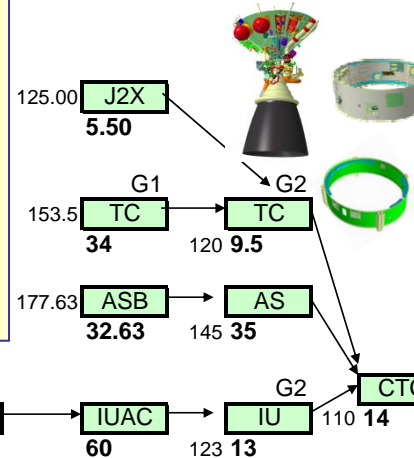
Merged Manufacturing Flow



Manufacturing Value Stream Map

- Vertical Tack and Weld
- Horizontal TPS Application
- Producability Summit
- Manufacturing Plan
- Manufacturing Floor Plan at Michoud
- Tooling Design and Fabrication

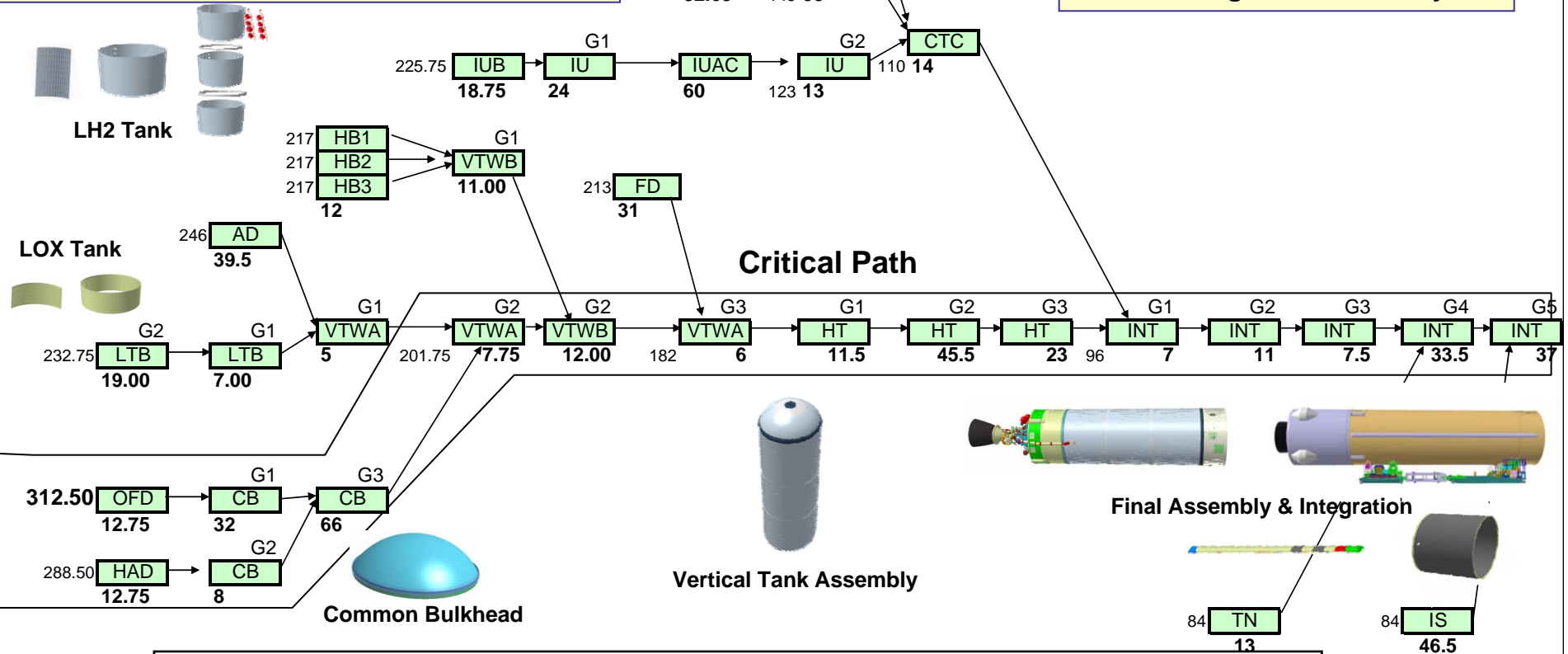
Common Test Cell



Metrics

NASA Baseline	420 days
Boeing Contract	347 days
Merged VSM	320 days
With learning	<300 days

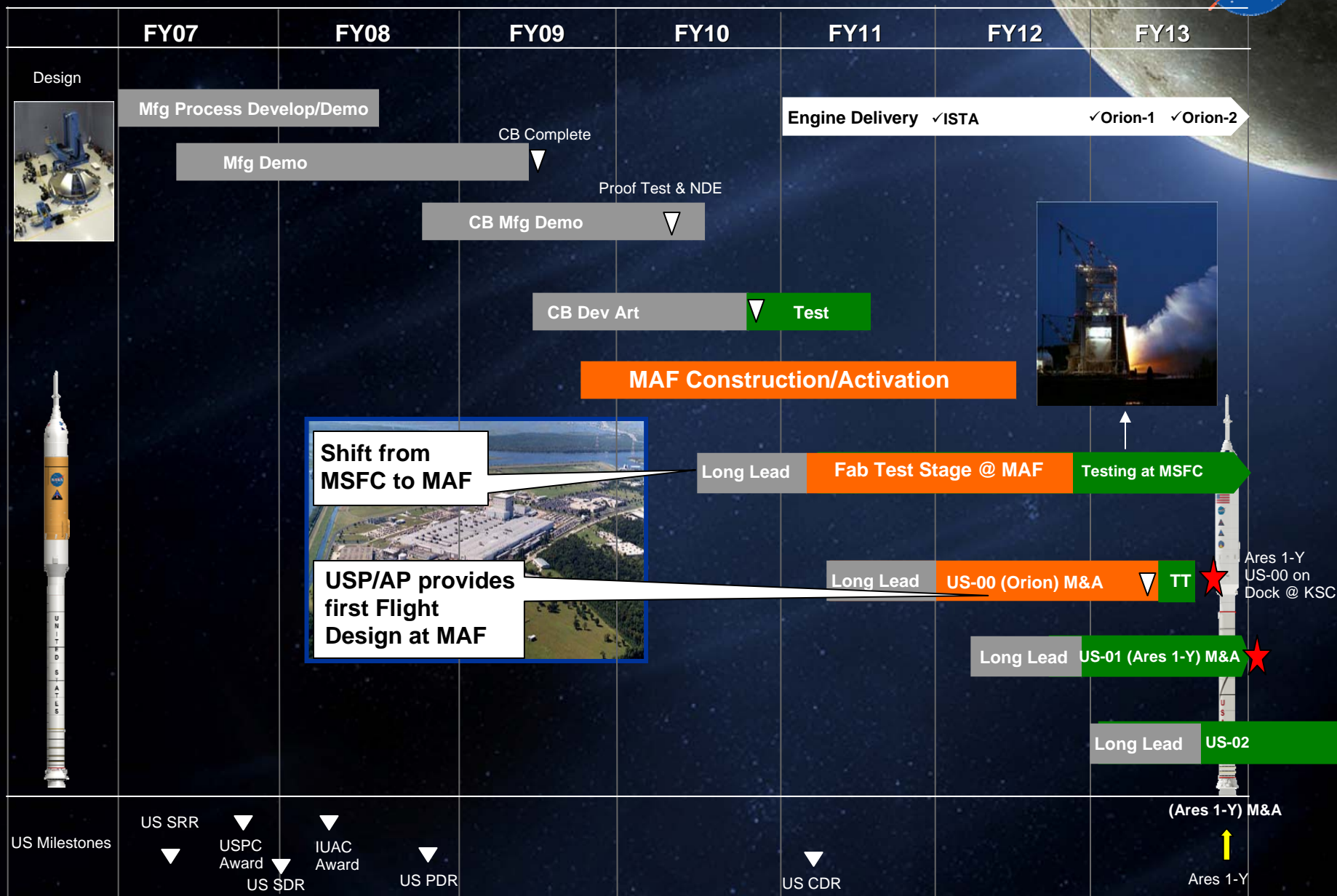
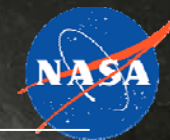
Critical Path



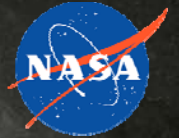
Boeing, working with NASA, Reduced Assembly Flow Over 100 days

Ares I Upper Stage Summary

PMR 08 Rev 1 Re-Plan Preliminary



Summary



- ◆ **The Ares family will provide the U.S. with unprecedented exploration capabilities**
 - Can inject ~40% more mass to the Moon than Apollo/Saturn
- ◆ **The Ares team has made significant progress since its inception in October 2005**
 - Full team is onboard
 - All major milestones met to-date, with PDR completed late Summer 2008
 - Ares I-X test flight is on schedule for 2009
- ◆ **We are making extensive use of lessons learned to minimize cost, technical, and schedule risks**
- ◆ **The NASA-led / Contractor partnership is very effective in developing the Ares I**





www.nasa.gov/ares